T E C H N O L O G Y F O R
Alaskan Transportation
DOT Statewide Research, Development,
& Technology Transfer
Local Technical Assistance Program
"Improving Alaska's quality of transportation through technology application, training, and information exchange."

Fall 2010 Volume 35, No. 2

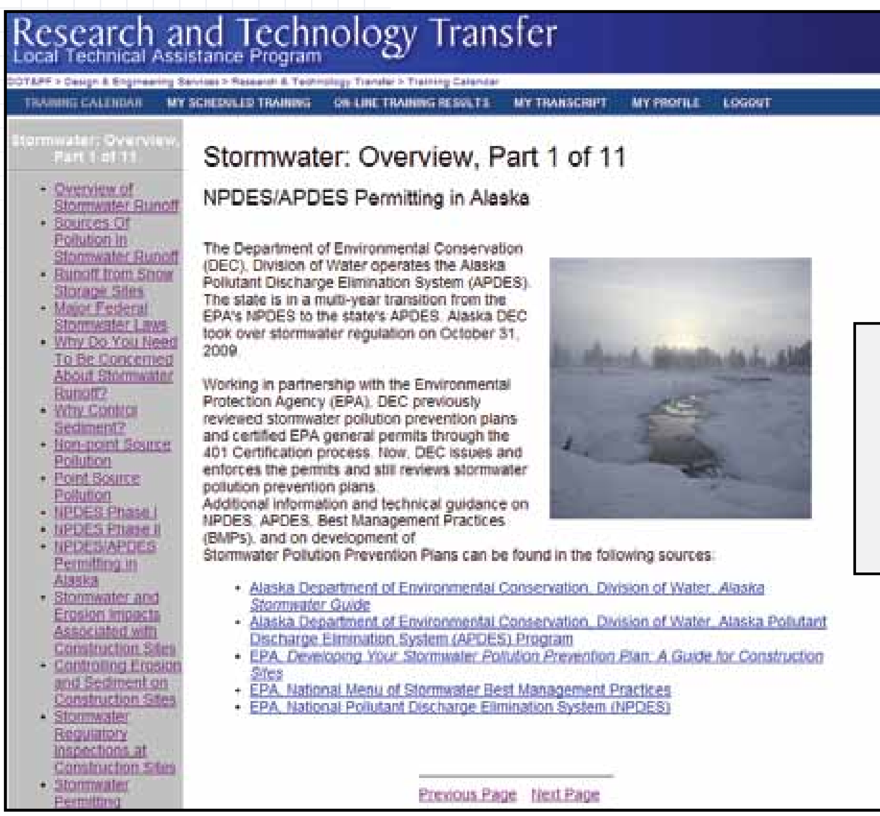
In this issue . . .

Publications and Training:
- On-line Environmental Awareness Training
- New DVDs Now Available
- Wildlife "Crash Course"
- High-Risk Rural Road Program publication is now Available
- NHI Updated Web-based Training
- Sign Maintenance Guide Now Available

Research Highlights:
- Evaluating Alternative Traffic Data Collection Devices
- Asset Management in a World of Dirt

T2 Launches On-line Environmental Awareness Training

Alaska-specific on-line environmental training for stormwater and wetlands is now available on the T2 web page. This program was developed to provide environmental awareness training for Alaska transportation employees who work for the State of Alaska, local governments, or for consultants and contractors working on state projects. This is a no-cost training and it's easily accessible via a web browser.



Use the following link to begin you training:

http://www.dot.state.ak.us/stwddes/research/index.shtml

Select "Wetlands and Stormwater Environmental Modules" under the "Training" heading on the T2 website. Follow login instructions.

For Alaska DOT&PF employees, the successful completion of all storm water modules may temporarily substitute for AK-CESCL certification as allowed by the Clean Water Act consent decree. This interim training option is not available to existing employees. Newly employed, transferred, assigned, or contracted employees are eligible. Also, AK-CESCL must still be obtained within six months of the hire (or transfer/contract) date.

> In addition to access from our main web page, you can also get to our on-line modules from our T2 Training Calendar as follows:
> 1. Login as a user at the T2 training calendar
> 2. Select "On-line Training" tab under "Training Links"
> 3. Select "Add On-line Training"

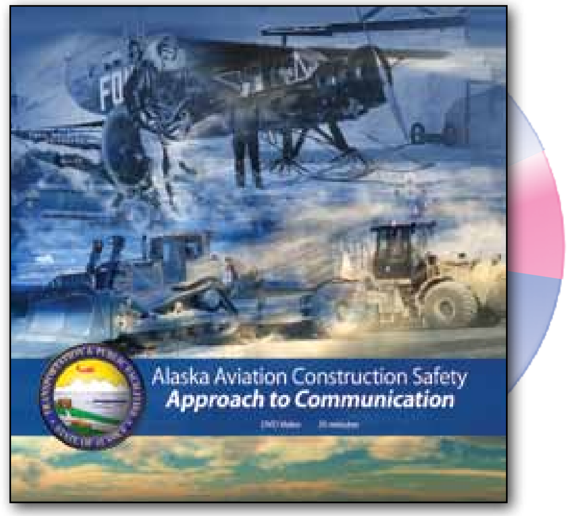
Please note: these modules are currently under regional DOT&PF review and are likely to have some ongoing changes. Comments can be directed to david.waldo@alaska.gov or kris.benson@alaska.gov

Now on DVD: Alaska Aviation Construction Safety: Approach to Communication

In the summer of 2008, a small video production team went into the field, talking to pilots, mechanics, airport managers, aviation experts, and construction crews about what a construction project means to the safe operation of an airport. The information trickled in at first, then slowly built as people talked about their experiences, what they had learned, and what they would like to see in the future.

The result is a video that reflects the challenges of bringing the improvements to the airport while accommodating an active runway. Several issues emerged as the video developed. They were not complicated, but were things that put people and equipment at risk and needed to be addressed. In this video you'll find aviation terminology, dos and don'ts, lessons learned, and some graphic representations of temporary markings.

What's the real lesson to take from the video? That communication is a crucial and ongoing process that must occur between the contractor, Alaska DOT&PF, and pilots during airport construction.



This video was created with collaboration between

- Alaska DOT&PF Northern Region Construction;
- Alaska DOT&PF Research, Development, and T2; and
- Federal Aviation Administration.

For free copies of this video please contact T2 at 451-5320 or suzanne.harold@alaska.gov.

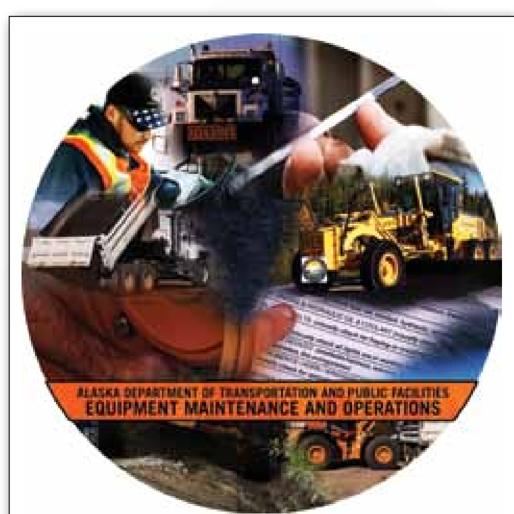
Also on DVD: Inspection and Operating Procedures for the Grader, Loader, and Truck

Maintenance and operations is a critical part of any DOT. After the engineers have called it a day, and the construction equipment has moved to another job, it's the operator who cares for the roads, highways, bridges and airports. They ensure our infrastructure continues to serve the public. And it's not just about removing snow, it's about extending the life of the facility and keeping it safe for the public to use by taking care of the road surfaces, the lighting, pavement markings, signage, drainage, and brushing back vegetation that threatens visibility.

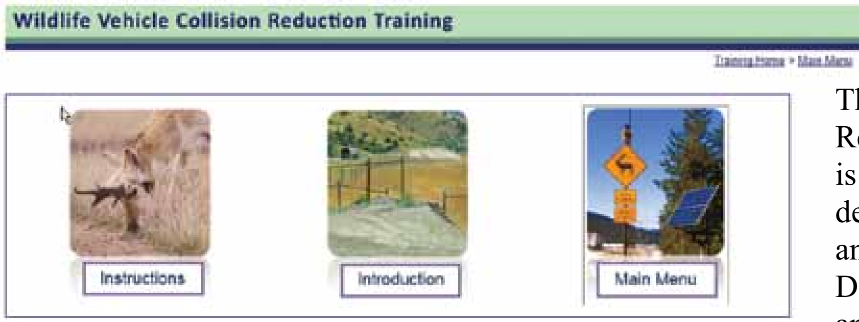
Maintenance personnel are also the eyes and ears for Alaska DOT&PF, giving critical feedback on how the facility is holding up, what's working and what's not. They serve as the department's public interface.

This goal of this video is to help the newer operator learn some valuable skills and as a refresher for the more experienced operator. This video was produced with collaboration from three Alaska DOT&PF sections: Research, Development & T2; Statewide Maintenance & Operations; and Northern Region Maintenance & Operations

Copies are available at T2 by calling 451-5320 or suzanne.harold@alaska.gov



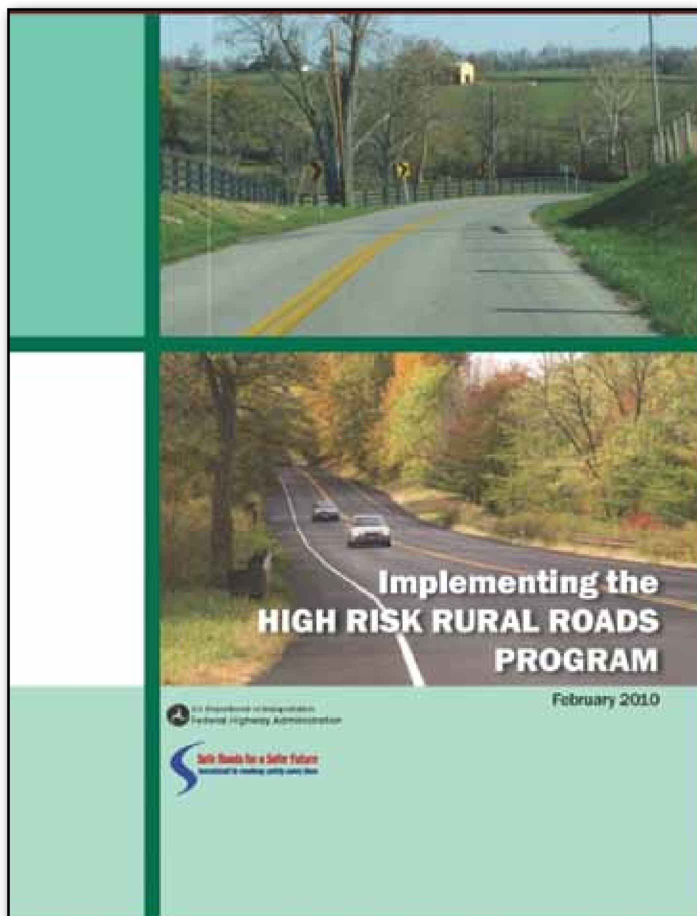
Wildlife "Crash Course" Now on Web



The FHWA Wildlife Vehicle Collision Reduction Study web-based training course is now available. The course was jointly developed by the Office of Safety Research and Development, the Office of Project Development and Environmental Review, and the Office of Federal Lands Highway.

http://www.environment.fhwa.dot.gov/WVCtraining

High-Risk Rural Road Program Publication is Now Available



The publication *Implementing the High Risk Rural Road Program* is now available on the Office of Safety website and can be accessed at: http://safety.fhwa.dot.gov/local_rural/training/fhwasa10021/

The document highlights common challenges to the High Risk Rural Roads Program (HRRRP), lessons learned, and noteworthy practices shared by states. It is intended for use by states and relevant stakeholders to launch their HRRRP, identify next steps to a program already moving forward, or implement noteworthy practices to improve an established program.

The publication contains useful information and resources. It addresses common challenges of the HRRRP:

- Data –crash, exposure
- Project Selection
- Coordination
- Administration, Policies and Legislation

It also examines steps some states have taken towards successful implementation of their HRRRP.

After four years of the HRRRP, the overall funding obligation rate for the program has remained low. Only 44 percent of funds available have been obligated by the States as of September 31, 2009. Many states have struggled with their HRRRP, however, implementation of the HRRRP can make a difference in rural road safety.

NHI Updated Web-based Plan Reading Series

The National Highway Institute and Transportation Curriculum Coordination Council (TCCC) announce that the updated web-based training, TCCC plan reading series is available on line.

To enroll in any of the free courses, go to http://www.nhi.fhwa.dot.gov/training/list_catalog.aspx?cat=&key=&num=&loc=&sta=%&typ=3&ava=1&str=&end=&tit=&lev=&drl=.

The ability to read plans is essential for anyone involved in highway and/or bridge construction. This training contains modules covering both basic plan reading instructions, and in-depth instruction for anyone seeking more information or a review of plan reading.

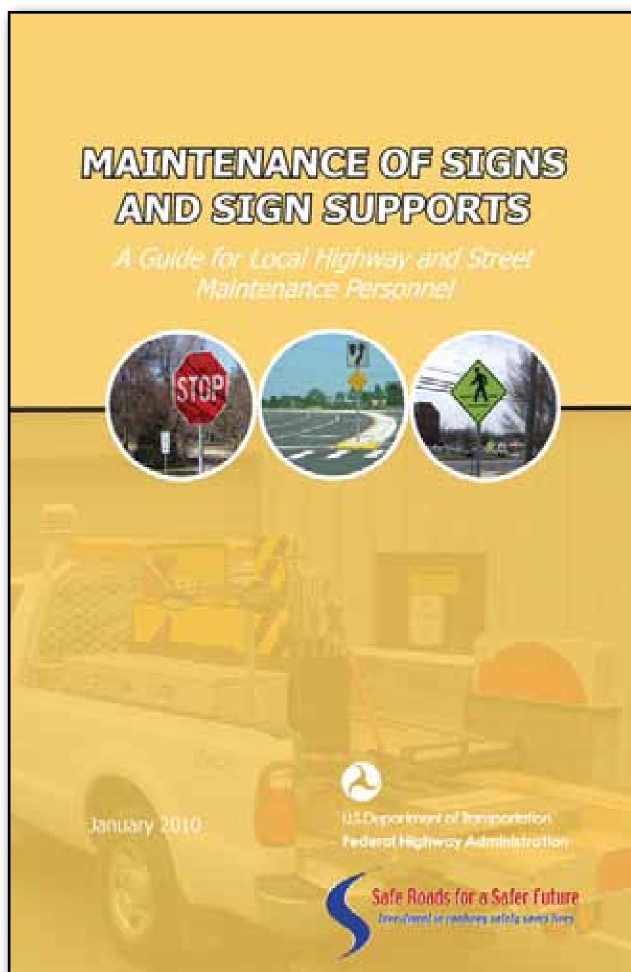
To streamline registration and enable participants to take some or all of these trainings, we have created a new plan reading series option. When a participant registers for 134108, they will be automatically registered for all eight modules. The following modules are included in the series:

- Module 1: Highway Plan Reading Basics (134108A)
- Module 2: Grading Plans (134108B)
- Module 3: Traffic Control Plans (134108C)
- Module 4: Erosion and Sediment Control Plans (134108D)
- Module 5: Right of Way Plans (134108E)
- Module 6: County Plans (134108F)
- Module 7: Bridge Plans (134108G)
- Module 8: Culvert Plans (134108H)

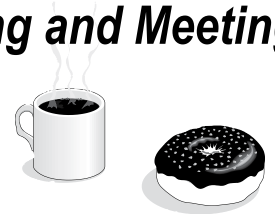
Updated Sign Maintenance Guide is Now Available

The *Maintenance of Signs and Sign Supports: a Guide for Local Highway and Street Maintenance Personnel* guidebook can now be downloaded at: http://safety.fhwa.dot.gov/local_rural/training/fhwasa09025/

Highway signs are the means by which the road agency communicates the rules, warnings, guidance, and other highway information that drivers need to navigate their roads and streets. This guide, which is an update to the same titled guide published in 1990, is intended to help local agency maintenance workers ensure that their agency's signs are maintained to meet the needs of the road user. The guide succinctly covers the following topics: a description of sign types, sign materials, and sign supports; sign installation; and the elements of a sign management system, including inventory, inspection, preventive maintenance, repair and replacement, and recordkeeping.



Training and Meeting Calendar



Meetings Around Alaska

Society	Chapter	Meeting Days	Location	Contact
ASCE	Anchorage	Monthly, 3rd Tues., noon	Moose Lodge	
	Fairbanks	Monthly, 3rd Wed., noon except Sept. and Feb.	Westmark Hotel	
	Juneau	Monthly, 2nd Wed., noon except June–Aug	2nd Fl. Conf. Rm at AEL&P	
ASPE	Anchorage	Monthly, 2nd Thurs., noon except summer	Coast International Inn	Jennifer Gibson, 343-8130
	Fairbanks	Monthly, 1st Mon., noon	Regency Hotel	
	Juneau	Monthly, 2nd Wed., noon except June–Aug.	2nd Fl. Conf. Rm at AEL&P	
ASPLS	Anchorage	Monthly, 3rd Tues., noon	Sourdough Mining Co.	George Strother, 745-9810
	Fairbanks	Monthly, 4th Tues., noon	Westmark Hotel	
	Mat-Su Valley	Monthly, last Wed., noon	Windbreak Cafe	
AWRA	Northern Region	Monthly, 3rd Wed., noon	Rm 531 Duckering Bldg., UAF	Larry Hinzman, 474-7331
ICBO	Northern Chapter	Monthly, 1st Wed., noon except July and Aug.	Zach's Sophie Station	Tom Marsh, 451-9353
ITE	Anchorage	Monthly, 1st Tues., noon except July and Aug.	Ak. Aviation Heritage Museum	Karthik Murugesan, 272-1877
IRWA	Sourdough Ch. 49	Monthly, 3rd Thurs., noon except July & Dec.	West Coast International Inn	
	Arctic Trails Ch. 71	Monthly, 2nd Thurs., noon except July & Dec.	Zach's Sophie Station	
Asphalt Pavement Alliance	Alaska	3rd Wednesday of every other month	varies	John Lambert 267-5294
PE in Government	Anchorage	Monthly, last Fri., 7 a.m.	Elmer's Restaurant	
Soc. of Women Eng.	Anchorage	Monthly, 2nd Wednesday at 5:30pm.	DOWL HKM	Stephanie Mormilo at 562-2000 Virginia Groeschel at 562-2000

Alaska T2 Training Listserve

Stay informed on training scheduled for federal, state, and local transportation agencies, including consultants, contractors, and other transportation professionals. Now you can receive updated training information every few weeks. To subscribe to the listserve via a web browser connect to the following address:

http://list.state.ak.us/guest/RemoteListSummary/DOT_Training_Notification_list

Simply enter your e-mail address into the text box of the online Mailing List Summary Form. You'll receive a confirmation e-mail and then you'll be notified periodically as new trainings are posted to our website.

For information about T2-sponsored training, contact:

Dave Waldo at 907-451-5323, david.waldo@alaska.gov
or
Simon Howell at 907-451-5482, simon.howell@alaska.gov
or go to: www.dot.state.ak.us

Research Highlights

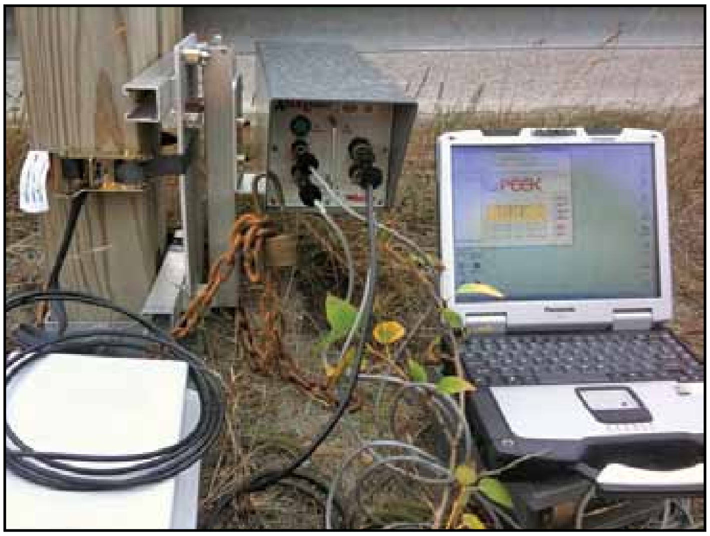
Evaluating Alternative Traffic Data Collection Devices

A study completed this spring tested the performance of two innovative nonintrusive traffic data collection devices for application in Alaska. The project, initiated by AKDOT&PF and carried out by department personnel, attempted to test two devices, a pole-mount radar system and a ground-mount axle-counting system, against the performance of existing methods, namely road tubes and inductive loop detectors. Road tubes have proved difficult to use on gravel roads because of the risks of counter tube puncture and displacement. Inductive loops can be sensitive to the expansion and contraction of the road bed caused by seasonal fluctuations in temperature. Both methods also expose DOT&PF personnel to traffic during installation. The new systems were evaluated according to two primary criteria: performance of the sensor in terms of accuracy as compared with road tubes and inductive loops, and the ease of deployment and calibration of the systems at the field site.

The pole-mount system, the Wavetronix SmartSensor HD, is affixed to existing roadside infrastructure and detects vehicles with a radar sensor. It uses a high-capacity, deep-cycle battery that is charged and then left to power the system for the duration of the seven-day data collection period. Data is stored in "bins" on the sensor's internal memory. A complete system is comprised of two or three vertical poles, a telescoping rod for fine vertical adjustment, batteries, and a battery box. A two-pole setup can support a sensor to a height of 16 feet and a three-pole setup can extend to 24 feet. At 16 feet, adjustments can be made with a telescoping pole, whereas at 24 feet all adjustments must be made by hand. Power is supplied by four 12 VDC deep-cycle rechargeable 55 amp-hour batteries, each of which can support the 7.5 watt sensor for a minimum of three days. Four batteries can support the system easily for nine days.

The ground-mount axle-counting system evaluated was the AxleLite sensor, which uses laser sensors mounted on the side of the road to detect traffic volume and speed and to identify vehicles either by the FHWA's thirteen classifications or a user-configurable classification scheme. The system requires the deployment of two sensors mounted approximately 10 to15 feet apart on guard rail posts or similar structures. The laser sensors must be within 1 to 2 inches higher than the crown of the roadway and are mounted with hardware that allows for fine adjustments to the height, horizontal angle, and vertical angle of the lasers. Ranging lasers reflect off vehicles to determine the distance from the sensor to the vehicle, which indicates which lane the vehicle is travelling in. The system requires significant configuration, which is primarily a manual process: lane dimensions and additional geometric objects are entered in the system by the user, with a limited ability of the system to expound upon the given information (adding additional identical lanes, etc.).

The study took place between July 2008 and February 2010, with data collected from nine locations, representing all three DOT&PF regions. Both two-and four-lane roadways were tested and the data compared to a baseline source, usually an inductive loop detector that had been tested for consistency and accuracy. Personnel conducting the tests also recorded information related to roadway geometry, the location of the sensor, and installation and calibration issues. At one site, the pole-mount system was also used to detect pedestrians and bicyclists.



The pole-mounted Wavetronix system proved to be a capable method of collecting traffic volumes. Tested over a wide variety of locations, the system tested well along four of the five performance test objectives: high volume roads, low-volume roads, gravel roads, and roads with rutting. However, the system's ability to detect pedestrians and bicyclists is uncertain: the small sample size of this data set prevents definitive conclusions, although it appears that the system is capable of detecting bicycles but not pedestrians. Deployment issues for this system were a concern. The size and weight of the battery system required to run the sensor for seven days of data collection negatively affects how the system can be transported and deployed. The system also takes a great deal of time to calibrate in locations with low traffic volumes. The auto-calibrate faculty of the system requires a certain volume of traffic, making the system impractical where the volume of traffic is low. Also, the system performs unreliably in situations where lanes and direction of travel are unclear, such as on the Dalton or in the winter when snow obscures the pavement and lane discipline is poor. It is also often difficult to find adequate infrastructure on which to mount the system.

Tests of the AxelLite system did not yield any data due to consistent difficulties encountered when deploying and calibrating the system. After multiple attempts to install the system failed, even with personnel working directly with the manufacturer, the experiment was abandoned. Deployment and calibration issues noted include the size and weight of the battery, severe pavement rutting resulting in vehicle tires dropping an inch or more below the roadway surface, obtaining and verifying proper alignment between the two sensors (which require parallel aiming), and the difficulty of using the mounting harness to strap the sensor securely to the infrastructure. Although no data was obtained for this study, Regional staff are working with the AxelLite equipment to continue evaluations of the system for potential application in Alaska.

The author of the study recommends that AKDOT&PF continue to investigate other, more simple sensors that are more quickly and simply deployed and consume less power, thus reducing the size of the battery required (shorter data collection periods may also accomplish this). They further recommend researching methods used by other state DOTs to detect pedestrian and bicyclist data, as well as examining the use of the AxleLite in applications in the Lower 48. Continuing research into how non-intrusive traffic data collection systems are affected by environmental factors will also yield information as to how to practically deploy them in Alaska.

The study, Demonstration of Nonintrusive Traffic Data Collection Devices in Alaska was directed and documented by Erik Minge, P.E., and field work was conducted by AKDOT&PF staff.

Questions about this research project can be directed it's DOT&PF Research Manager Angela Parsons at 907-269-6208.

Research Highlights

Asset Management in a World of Dirt:

Emergence of an Underdeveloped Sector of Transportation Asset Management

Dave Stanley, J.D., C.P.G., L.G., L.E.G.

The author is chief engineering geologist for Alaska DOT&PF, Anchorage, Alaska, and chairs the TRB Engineering Geology Subcommittee on Geotechnical Asset Management.

Transportation agencies around the United States and the world are adopting transportation asset management (TAM) as a strategic means of focusing on long-term management of government-owned assets[1,2]. While great strides have been made in developing TAM concepts and tools, not all classes of assets have been adequately addressed. For example, little attention has been paid to management of geotechnical assets such as retaining walls, embankments, rock slopes, rockfall protection barriers, rock and ground anchors, soil nail walls, material sites, tunnels, geotechnical instrumentation and data, etc. While some state agencies and others have recognized the need and attempted to press forward in applying asset management concepts for geotechnical assets, those efforts have largely been isolated instances. Further, these efforts have been limited and have not applied the full gamut of the TAM process from asset inventories, condition assessment (including service life estimates) and performance modeling, alternative evaluation (based on life-cycle-based decision-making), project selection, and performance monitoring (see Figure 1. - Generic Asset Management System).

Most geotechnical asset management (GAM) efforts have been limited to inventorying and condition surveys, without making much progress along the TAM spectrum. For example, agencies are unlikely to have geotechnical-specific performance standards against which agencies may judge the actual performance of their assets. Likewise, little is available in regards to determining or estimating the service life of geotechnical assets. There are notable exceptions. For instance, much work has been accomplished in assessments of corrosion and degradation and remaining service life estimates of buried metal reinforcements in retaining walls[3,4,5].

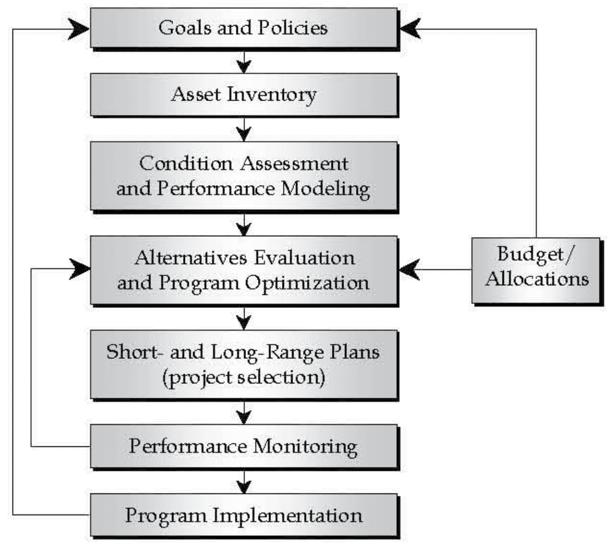


Figure 1: Generic asset management system

Recently, efforts have begun to promote further development of geotechnical asset management as part of the broader efforts to develop and implement transportation asset management generally. For example, at the 2010 TRB annual meeting, the Engineering Geology Committee (AFP10) formed a Geotechnical Asset Management Subcommittee to address research needs in this area. The subcommittee will hold its first formal meeting at the January 2011 TRB annual meeting.

In addition, individual efforts are underway in various agencies to incorporate GAM principles into ongoing research and management programs. For example, an NCHRP research program (Project 24-35) is underway to create guidelines for certification and management of flexible rockfall protection systems and determine long-term performance characteristics and metrics for use in asset management programs. Alaska DOT&PF is conducting research for an asset management-based Unstable Slope Management Program. Wyoming DOT has created a geotechnical asset management-based geology database to track and manage geologic maps, aggregate sources, and project information. The National Park Service has developed a Retaining Wall Inventory and Condition

Assessment Program (WIP) that incorporates asset management principles. Ohio DOT has a Retaining Wall Asset Management Program. These efforts and others, while laudable, for the most part are not integrated with a larger TAM program. Most states do not have geotechnical policies, goals, or performance measures. So, where geotechnical asset programs exist, the nexus to agency goals is tenuous at best.

Asset Management in a World of Dirt Symposium

Recently TRB sponsored a symposium titled "Asset Management in a World of Dirt," held in Oklahoma City in conjunction with the annual Highway Geology Symposium. The purpose of the symposium was to provide practitioners with information to help them manage geotechnical assets as part of TAM initiatives that are gathering steam across the country. The event was cosponsored by the TRB Engineering Geology Committee and the TRB Exploration and Classification of Earth Materials (AFP20). The symposium featured a keynote speech by Erik Loehr of the University of Missouri, Columbia, an early proponent of GAM and co-author of key GAM publications[6,7].

The six speakers provided an overview of asset management principles and the role of geotechnical asset management in the overall TAM picture. Erik Loehr, coauthor of some seminal GAM papers, delivered a keynote speech that reviewed some of the basics of asset management and then addressed several GAM problem areas and research needs. Other presentations addressed the issues associated with creating databases for conducting asset inventory and condition surveys, the early degradation of buried structural components in retaining walls and how geotechnical asset management can provide a framework for managing the problem. Another presentation provided a description of the National Park Service Retaining wall inventory and lessons learned from their inventory process. Two of the presentations resulted in papers published by the Highway Geology Symposium[8,9].

Why Geotechnical Asset Management?

Why should we manage geotechnical assets using asset management principles? Simply put, to reduce the life-cycle costs for geotechnical assets[3]. Agencies spend a significant portion of their funds on geotechnical assets. It is not overstating the case to say that every transportation asset rests on or is affected by a geotechnical asset—the ground we walk on, the embankments upon which we build roads, the rock slopes that adjoin our roadways, etc. However, little thought is given to the length of service provided by a well-built embankment or an unseen bridge foundation. Instead, geotechnical assets are often viewed negatively—thought about only when they fail.

When geotechnical assets deteriorate, most transportation agencies use a "worst-first" approach to determining when to repair, rehabilitate, or replace an asset. For example, rockfall inventory programs developed for many states rank rockfall sites with the expectation that the most dangerous sites will be addressed first[10]. Expending limited transportation funds only on worst-case problems guarantees steadily declining conditions for our transportation systems; asset management principles dictate spending money where it will have the most long-term positive effects.

Research Needs

Implementation and integration of geotechnical asset management parallel with existing agency TAM efforts faces some daunting hurdles. The possibilities for research are ample, and several aspects of GAM are in need of explication. While GAM practitioners have been conducting inventories and conditions surveys for many years[10], little progress has been made into other areas of asset management for geotechnical assets. Two critical needs are (1) devising performance standards and measures and establishing minimum levels of service, and (2) achieving an understanding of the expected performance of geotechnical assets.

Some preliminary efforts have been made at identifying performance standards specifically for geotechnical assets ("Unstable Slope Performance Standards" for AKDOT&PF Unstable Slope Management Program, Lawrence A. Pierson, 2010, unpublished data). However, it is likely that most state DOTs have not identified specific GAM performance standards and only have performance measures generally applicable to TAM. Creating performance standards may not be a complex task but will require effort to derive logical standards from generalized agency policies and goals and from presently unknown consumer expectations.

Once we have an understanding of the standards geotechnical assets must meet, we need to develop an understanding of the life cycle of the assets. In order to manage successfully, asset managers must be able to predict the condition of the assets into the future. In

(continued on next page)

some asset classes (for example, pavement) it has been possible to create deterioration curves that can be used to chart the future life of the asset. It is safe to say that many geotechnical assets do not lend themselves to a neat curve to define the course of their useful lives. Options for projecting the future condition of geotechnical assets include beginning with theoretical curves and then performing regression analysis to fit the curves. Obviously this process can take many years. For some geotechnical assets such as buried retaining wall reinforcements and rock bolts, formulas are available to calculate the expected life[3,4,5]. Considerable research is needed to determine the theoretical and actual service life and asset performance over time.

Next Steps for Geotechnical Asset Management

We are making significant progress in identifying and resolving inventory and condition survey issues for geotechnical assets, and many agencies have one or more inventory programs for retaining walls, rock slopes, etc. However, agencies nationwide do not yet have a clear understanding of what next steps must be taken after an initial geotechnical asset inventory is completed. In order for GAM to move forward, we must have a framework to understanding how agency strategic goals and performance measures can be met by implementation of GAM programs and the steps that must be taken to implement such programs. Some of the development of a framework for GAM was accomplished several years ago[6], but the authors of the early work in this area acknowledged challenges in fully developing the framework, particularly in the areas of agency goals and analysis tools. Little or no visible follow-up has occurred to build on these efforts to formulate a usable framework.

Research is needed to continue the development of geotechnical asset management. The focus for the research must extend beyond methods of conducting inventories and condition surveys. Our next steps should focus on creating performance standards for geotechnical assets and finding ways to tie agency goals to GAM implementation. We also must have a better understanding of how geotechnical assets change over time so we can determine the optimum time to repair, rehabilitate, or replace an asset. Determining the characteristics of an asset's life will take years-long research projects. Some projects have already taken first steps in this regard, but more work is needed.

Looking Further Down the Road

The TRB subcommittee on GAM will be formulating research needs statements over the next year, focusing on how to move forward with GAM beyond the initial steps. As we begin work to understand how performance standards for geotechnical assets can be related to the projected condition of the assets, we will also look further to the future at the availability of analysis tools and how we can use those tools to make rational decisions about geotechnical assets that comport with

(continued on back page)

References

1. Cambridge Systems, Parsons Brinckerhoff Quade & Douglas, Roy Jorgenson Associates, and Paul D. Thompson. "Transportation Asset Management Guide," November 2002. http://downloads.transportation.org/AMGuide.pdf.
2. Gordon, Mark, George JasonSmith, Paul D. Thompson, Hyun-A Park, Frances Harrison, and Brett Elston. "AASHTO Transportation Asset Management Guide Supplement," 2010 (unpublished, but available in final draft at http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP08-69_TAM_GUIDE_VOLUMEII.pdf).
3. Fishman, Kenneth L. "Phase I: Condition Assessment and Evaluation of Rock Reinforcement Along I-93," Publication FHWA-NH-RD-13733L, New Hampshire Department of Transportation, Concord, NH, 2004.
4. Elias, Victor, Kenneth L. Fishman, Barry R. Christopher, and Ryan R. Berg. "Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes," Publication FHWA-NHI-09-087 (Course Manual for NHI Courses 132042 & 132043), U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., 2009.
5. Fishman, Kenneth L., Robert A. Gladstone, and John J. Wheeler. "Condition Assessment of Earth Reinforcements for Asset Management," in Proceedings 60th Highway Geology Symposium, 2009.
6. Sanford-Bernhardt, Kristen L., J. Erik Loehr, and Daniel Huaco. "Asset Management Framework for Geotechnical Infrastructure," ASCE Journal of Infrastructure Systems, Vol. 9 No. 3, September 2003, pp. 107–116; http://cedb.asce.org/cgi/WWWdisplay.cgi?0304099.
7. Loehr, J. Erik, Kristen L. Sanford-Bernhardt, and Daniel Huaco. "Decision Support for Slope Construction and Repair Activities: An Asset Management Building Block," Publication MoDOT RDT 04-006/RI00-014. Midwest Transportation Consortium and University of Missouri Columbia, February 2004; http://www.itrans.iastate.edu/reports/Loehr_decision_slope_2000.pdf.
8. Hansen, Blaise, and Mike Schulte. "The Geology Program's Contribution to the Wyoming Department of Transportation Asset Management Program," in Proceedings 61st Highway Geology Symposium – TRB Symposium "Asset Management in a World of Dirt," Oklahoma City, OK, 2010.
9. Thornley, John, Raj V. Siddharthan, and David A. Stanley. "MSE Wall Corrosion in Nevada: A Case Study in Geotechnical Asset Management," in Proceedings 61st Highway Geology Symposium – TRB Symposium "Asset Management in a World of Dirt," Oklahoma City, OK, 2010.
10. Pierson, Larry A., and Robert Van Vickle. "Rockfall Hazard Rating System – Participant's Manual," Publication FHWA: SA-93-057, (Course Manual for NHI Course 130220), U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., 1993.

Figure 2: Rock retaining wall/culvert outlet, Glacier National Park (from NPS Wall Inventory Program Procedures Manual)

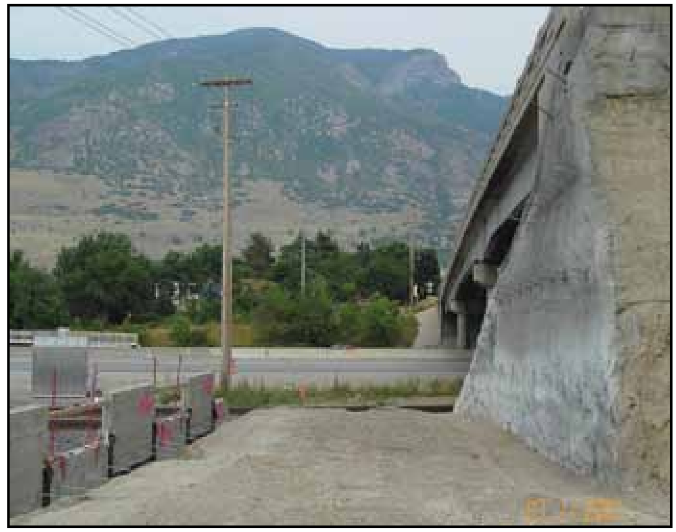


Figure 3: Bridge approach MSE wall under construction with temporary support from soil nail and shotcrete wall, Legacy Parkway, Utah

Figure 4: Nenana Canyon rockfall barrier, Parks Highway, Alaska, near Denali National Park. Larry Pierson, Landslide Technology.

Figure 5: Installation of soil nails and wire mesh on soil slope in California

ALASKA TRANSPORTATION
TECHNOLOGY TRANSFER
Local Technical Assistance Program
Department of Transportation and Public Facilities
2301 Peger Road M/S 2550
Fairbanks, AK 99709-5399

Return Service Requested

Asset Management *(continued from page 10)*

asset management principles and provide agencies with the optimum course of action for our geotechnical assets.

Continued development of asset management for geotechnical assets is a critical piece of the overall asset management puzzle. As TAM continues to mature, GAM must continue to make similar steps. When developed and implemented, GAM will offer a framework for monitoring performance to assure understanding of the current condition and project performance of geotechnical assets. GAM offers agencies the ability to make life-cycle cost-based choices about whether to monitor, rehabilitate, repair, or replace significant assets. As efforts continue toward integration of GAM into the broader TAM effort, many opportunities for research will arise for those of us who work in the world of dirt.

Figure 6: Anchor bolts and instrumentation in rock slope at Barron Mountain on I-93, New Hampshire

This newsletter is funded by the Federal Highway Administration and the Alaska Department of Transportation and Public Facilities. The material contained herein does not necessarily reflect the views of the Alaska Department of Transportation, Federal Highway Administration, or the T^2 staff. Any reference to a commercial product or organization in this newsletter is only for informational purposes and is not intended as an endorsement.